Dominant Presence of Oxygenated Organic Species in the Remote Southern Pacific Troposphere

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Oxygenated organic species are intimately involved with the fate of nitrogen oxides (NO_x) and hydrogen oxides (HO_x), which are necessary for tropospheric ozone formation. A recent airborne experiment (March-April, 1999) focused over the Southern Hemisphere (SH) Pacific Ocean (Pacific Exploratory Mission-Tropics B (PEM-Tropics B)) provided a first opportunity for a detailed characterization of the oxygenated organic composition of the remote Southern Hemisphere troposphere. Three co-located multichannel airborne instruments measured a dozen key oxygenated species (carbonyls, alcohols, organic nitrates, organic pernitrates, peroxides) along with a comprehensive suite of C_2-C_8 nonmethane hydrocarbons (NMHC). Analyses done in FY00 on these measurements reveal that in the tropical SH (0°–30°S), oxygenated chemical abundances are extremely large and collectively are nearly five times those of NMHC. Even in the northern hemisphere remote atmospheres, their burden is equal to or greater than that of NMHC. Therefore the global extent of oxygenated chemicals is greater than was previously thought. The relatively uniform global distribution of oxygenates is indicative of the presence of large natural and distributed sources. A global three-dimensional model, reflecting the present state of knowledge, is unable to correctly simulate the atmospheric distribution and variability of several of these species. More research is needed to discover the sources and transport mechanisms associated with these findings before global models can be improved to reflect this new information.

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ER-2 and DC-8 Meteorological Measurement Systems

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The Meteorological Measurement System (MMS) provides high-resolution, airborne meteorological parameters (pressure, temperature, turbulence index, and the three-dimensional (3-D) wind vector). The MMS consists of three major systems: (1) an air-motion sensing system to measure the air velocity with respect to the aircraft, (2) an aircraft-motion sensing system to measure the aircraft velocity with respect to the earth, and (3) a data-acquisition system to sample, process, and record the measured quantities. Since much of the instrumentation is attached to the aircraft at judiciously chosen locations, the MMS is a platform-specific instrument that cannot be transported from one aircraft to another.

The MMS is uniquely qualified to investigate atmospheric mesoscale (gravity and mountain lee waves) and microscale (turbulence) phenomena. An accurate characterization of the